Description of the
Joint Engineering Team (JET)

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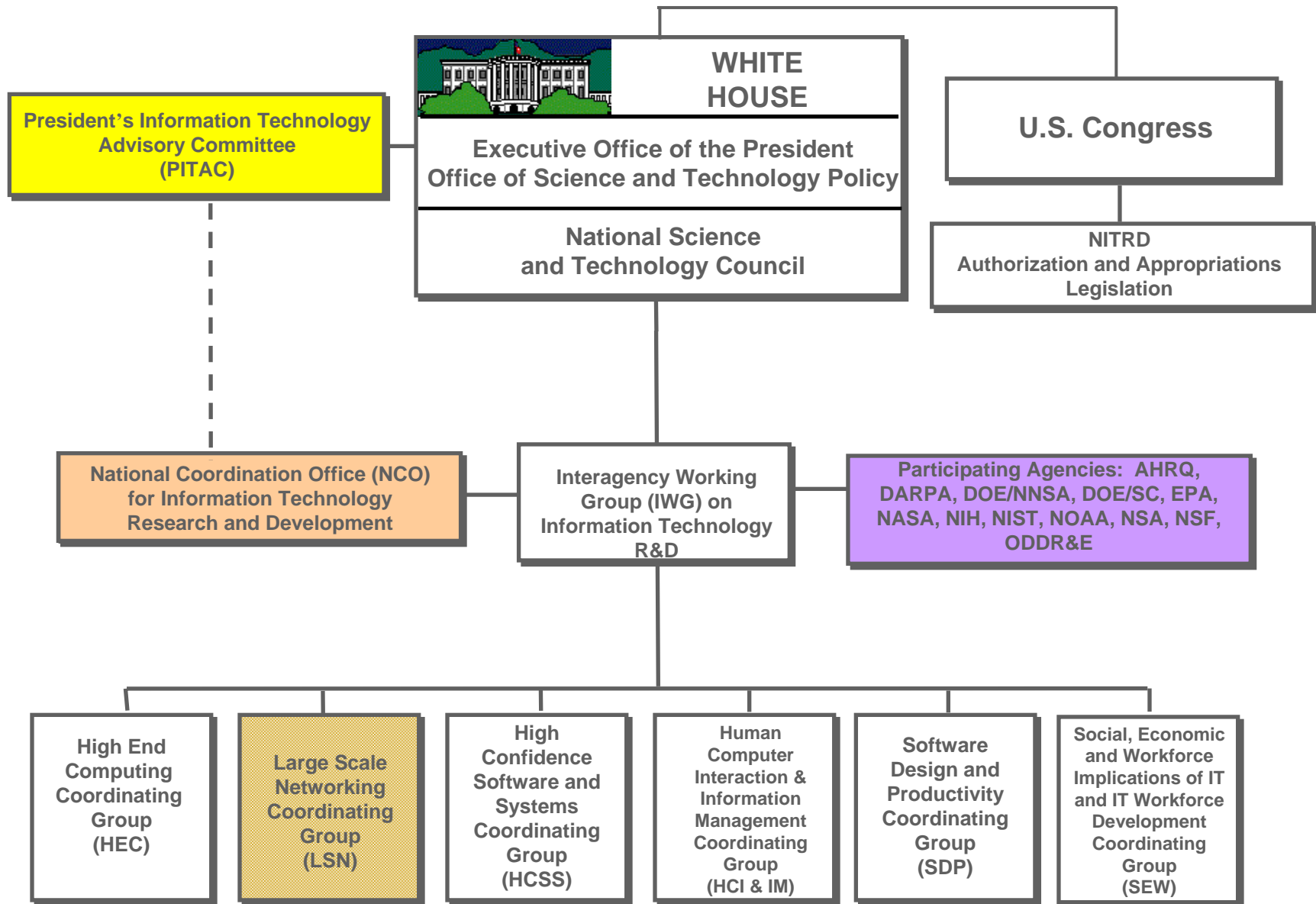DREN Networkers and Security Conference
Maui, HI
6 August 2004

Outline

- What the heck is a JET
  & where does it fit in
- Roadmap – where's a JET to go

Acknowledgements

- Doug Gatchell
- Dave Nelson
- Grant Miller
- George Seweryniak

NITRD Program Coordination

President's Information Technology Advisory Committee (PITAC)

WHITE HOUSE

Executive Office of the President Office of Science and Technology Policy

National Science and Technology Council

U.S. Congress

NITRD Authorization and Appropriations Legislation

National Coordination Office (NCO) for Information Technology Research and Development

Interagency Working Group (IWG) on Information Technology R&D

Participating Agencies: AHRQ, DARPA, DOE/NNSA, DOE/SC, EPA, NASA, NIH, NIST, NOAA, NSA, NSF, ODDR&E

High End Computing Coordinating Group (HEC)

Large Scale Networking Coordinating Group (LSN)

High Confidence Software and Systems Coordinating Group (HCSS)

Human Computer Interaction & Information Management Coordinating Group (HCI & IM)

Software Design and Productivity Coordinating Group (SDP)

Social, Economic and Workforce Implications of IT and IT Workforce Development Coordinating Group (SEW)

LSN & its Pieces

- **LSN**
  - Coordinates High Performance Research Network (HPRN) policy, interagency collaboration, and resource cooperation
  - Agency participants include: NIH, NSF, DARPA, DOE(SC), DOE(NNSA), ODDR&E, NIST, NASA, AHRQ, NOAA, NSA

- **NRT – Network Research Team**
  - Provides coordination among HPRN programs to leverage resources and promote collaboration and exchange of information

- **MAGIC – Middleware and Grid Infrastructure Coordination**
  - Promotes HPRN middleware tools development, interoperability, research coordination, and infrastructure persistence

- **JET- Joint Engineering Team**
  - Provides engineering coordination among HPRNs for transparency, interoperability, and sharing of resources

JET Charter

- Established in 1997

- Coordinates engineering, connectivity, interoperability and transparency among high-performance research networks (aka the JETnets) supporting the Federal Information Technology Research and Development (ITR&D) community community

Regular Participants

- BOSSnet
- DREN
- ESnet
- NREN & NISN
- NSF Experimental Infrastructure
- Abilene (Internet2)
- vBNS+
- NLR (National Lamba Rail)
- UltraScienceNet
- NGIXes (East & West)
- StarLight
- NOAA & USGS

JET Efforts

- **Exchange points**
  - ATM to GigE migration
  - StarTap to StarLight migration

- **Jumbogram "standardization" at 9,000 Bytes**

- **Shared resources**
  - Hawaii & Alaska

- **Gives a forum for collaborating on planning, operations, architecture, implementation and maintenance among the JETnets**

- **"Nudges" on such things as IPv6 and multicast**

JET Roadmap Workshop

- 13-15 April 2004
- Jefferson Lab, Newport News, VA
- 2 1/2 days
- Co-chaired
  - Bill Johnston (DOE-LBNL)
  - Jules Aronson (NIH)
- 68 attendees
  - Federal Agencies
  - DOE laboratories
  - Internet2
  - Telecom, Hardware and Software Vendors

Goals

- Develop a JET roadmap aimed at ensuring that Federal and University R&E networking issues for the next three years are addressed

- Develop a picture of where these networks will be in three years

- Examine what has to be done to ensure continued interoperability if future infrastructure expands beyond IP into the optical realm

- Develop strategy for integrating results of network research into the JETnets

Plenary Session

- **JET Networks Drivers**
  - What are the new science applications that will require new network infrastructure, performance, functionality, reliability, security, etc. over the next three years?
  - What are the applications that are stressing the existing networks?

Breakout Groups

- **Measurement and Performance**
  - Measurement status updates and plans
  - Measurement - both near-term and long term
  - Experimental Transport Protocols

- **Interoperability and Peering**
  - Security Topics and Disaster Recovery
  - International Connectivity
  - Next Generation Peering Technologies

- **Technology and the Directions for Optical Infrastructures**
  - Optical Internetworking
  - Future of Fiber Infrastructure

Summary: Measurement & Performance

- **A variety of performance measurements exist**
- **Cooperation is very important**
  - "Seamless Performance"
  - One infrastructure visibility for greater good (SNMP from everywhere)
  - NTP/timing for correlation
  - Need test points to divide & conquer
  - Support interdomain troubleshooting, ideally
- **One "box" for users**
- **One framework / schema**
- **But it's not baked yet – needs some experience**
- **Recommendations**
  - Charter a technical committee to design and lead the deployment of measurement infrastructures to measure end-to-end performance among and across this community of networks and their users.

Summary: Transport Protocols

- **TCP or not TCP**
- **Fallacies in TCP vs. xxP comparisons**
- **Various UDP-based alternatives**
    - NETBLT
    - Reliable Blast UDP
    - Tsunami
    - SABUL / UDT
- **Main advantages**
    - Deployability and experimentation
- **Recommendations**
    - No clear winner. As with the measurement session…
    - JETnets have leading-edge needs not felt by commercial networks
    - Encourage experimentation, lead/foster deployment
    - Make our needs heard to vendors

Summary: Interoperability & Peering

- **Security Topics**
  - High Speed Intrusion Detection - LBNL BRO
  - Immune system analogues
  - Authenticating Firewalls

- **International Connectivity**
  - Coordination
  - JET "matchmaking"
  - IDS at peering points
  - Budgets/politics of non-US countries
  - Underserved areas

- **Peering Technologies and Disaster Recovery**
  - Fednets backing each other up
  - Notion of having scalable nodes
  - Life support using commodity networks

- **Recommendations**
  - JET needs to discuss these in much more detail at future meetings

Summary: Technology & the Directions for Optical Infrastructures (1/2)

- Need for common architectures to explore coordinated advanced capabilities of optical networks
- Protocols for optical networks – what's next????
- A definition of common services for experimental optical networks
  - Examples
    - Inter-domain signaling
    - Monitoring
    - Services discoveries
    - SLAs
  - JET/NRT must play a role

Summary: Technology & the Directions for Optical Infrastructures (2/2)

- Need for new JETnet coordination strategies as federal agencies develop new models of federal networks procurement based on customers-owned

- Customer-owned networks enable a greater flexibility to deploy and test new optical technologies are needed

- Recommendations:
  - Focus on:
    - Optical Network Technologies
    - Experimental Networks
    - FiberCo, NLR

Next Steps

- Discuss interoperability and peering at upcoming JET meetings
- Develop Draft Report
  - Outline attached at end of the on-line slides
- Circulate Draft Report to JET
- Publish Final report by Sept/Oct 2004
- Agenda and Presentations are at:
  - http://www.itrd.gov/iwg/lsn/jet/conferences/20040413/index.html
- List of attendees is at:
  - http://www1.jlab.org/Ul/conferences/jet/admin/view.cfm
- Measurement Committee:
  - Matt Zekauskas <matt@internet2.edu>

The End

Workshop report outline follows

JET Roadmap Workshop

April 13-15, Jefferson Lab, Newport News, VA
Draft Report, version 1

Contents

<u>Executive Summary</u>

1 Introduction, Goals, and Organization

The role of the JET …

Why the workshop ….

Goals:

> 1) Develop a JET roadmap aimed at ensuring that U. S. Government and University Research and Education networking issues for the next three years are addressed.
>
> 2) Develop a picture of where these networks will be in three years.
>
> 3) Examine what has to be done to ensure continued interoperability if future infrastructure expands beyond IP into the optical realm.
>
> 4) Develop strategy for integrating results of network research into the JETnets.

The Organizing Committee …..

2 JET Networks Drivers

What are the new science applications that will require new network infrastructure, performance, functionality, reliability, security, etc. over the next 3 years? What are the applications that are stressing the existing networks?

- o DOE Office of Science
- o DREN
- o ESnet
- o Internet2
- o NIH
- o NSF CISE/Science
- o NASA

3. Technology and the Directions for Optical Infrastructures

An examination of optical networking R&D, testbeds, and experimental deployments.

3.1 Optical Internetworking

3.1.1 All-Optical Internetworking

- o Infinera
- o Movaz Networks

3.1.2 Roadmaps for Experimental Optical Internetworking

- o UltraScienceNet, DOE
- o CHEETAH, NSF
- o DRAGON, NSF
- o OMNInet, NSF
- o Starlight, NSF
- o HOPI, NSF

3.2 Future of Fiber Infrastructure

3.2.1 Non-traditional perspectives

- o FiberCo
- o National Lambda Rail
- o IWire

3.2.2 Carrier Perspectives

- o Qwest
- o Level 3

4. Interoperability and Peering

4.1 Next Generation Peering Technologies

o   Inter-domain signaling/RSVP technologies, QOS, and MPLS

o   VLANS as inter-domain circuit exchange points

o   The future of Starlight

o   Minimally compatible authentication infrastructure for inter-domain circuit establishment

4.2 Security and Disaster Recovery

o   High-speed intrusion detection and response

o   Authenticating firewalls

o   Immune system analogues approaches

o   Interoperability for JETnets mutual assistance in the event of
   –   Policy issues / coordination

o   NOC coordination, contingency planning
   –   Worm / virus response
   –   End-to-end problem solving
   –   Cross-domain monitoring
   –   Outage footprint publication

5. International Connectivity

o   International networking requirements and plans for next three years

o   What users do you need to connect?

o   What issues do you expect to face?

o   What can the JET help with your requirements?

o   What effect do other FedNets have in your area

5.1 Overview of International Research Networks

o   Drivers and requirements for high end International Research

o   DREN - International Networking Status and Plans

o   NREN – International Networking Status and Plans

o   NISN/NASAnet – International Networking Status and Plans

o   USGS – International Networking Status and Plans

o   NOAA – International Networking Status and Plans

o   DOE - International Networking Status and Plans

6. Measurements and Performance

6.1 JetNet Measurement Status and Plans

o   DREN

o   NASA

o   WAN Measurement

o   End to End Troubleshooting

o   Abilene

o   Internet2 piPEs

o   Internet2 End-to-End Measurement Workshop results

6.2 Near-term and Long term Issues

Examination of the issues focused on diagnostics / troubleshooting, security, performance / Service Level Agreements, and the sub-IP and optical layer.

o   Measurement coordination and data sharing among JETnets
  – What requirements do we have for interdomain measurement and performance visibility?
  – Given current capabilities of each JETnet, can we prioritize and set goals on what measurement data and services to make available, and in what forms?
  – Is Ipv6 really that important, and how accurately can/do we measure Ipv6 traffic and performance today?
  – How do you measure 10 Gb/s and beyond links?
  – Issues in authN and authZ
  – Multicast

o   What new capabilities do we anticipate leveraging? How will we measure in the optical domain?

o   Are current standard technologies and protocols, such as SNMP, necessary and sufficient for the longer term? If not, what needs to be replaced or enhanced?

7. Experimental Transport Protocols

o   Assessment of TCP/UDP for JET nets

o   Overview of new TCP-ish protocols

o   Overview of new UDP-based protocols

o   What issues, if any, exist for integrating new transport protocols into existing networks (e.g. XCP)

o   Do JETnet have a role in leading deployment of new transport protocols, and if so, to what extent?

o   What special considerations exist for a 3-year time horizon, e.g. facilitating "circuit-like" end-to-end services

Appendices

A. Participants

B. Workshop Agenda

C. Talk Summaries

The End

(Really ☺)